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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/663,838	09/17/2003	Masaaki Hirakawa	026390-00011	2691
4372	7590	02/06/2006	EXAMINER	
ARENT FOX PLLC 1050 CONNECTICUT AVENUE, N.W. SUITE 400 WASHINGTON, DC 20036			MARKHAM, WESLEY D	
			ART UNIT	PAPER NUMBER
			1762	

DATE MAILED: 02/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/663,838

Applicant(s)

HIRAKAWA ET AL.

Examiner

Wesley D. Markham

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7, 9 and 10 is/are pending in the application.
- 4a) Of the above claim(s) 9 and 10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Acknowledgement is made of the amendment filed by the applicant on 11/22/2005, in which a new abstract of the disclosure was submitted, the specification of the instant application was amended, Claims 1, 2, 4, and 7 were amended, and Claim 8 was canceled. Claims 1 – 7, 9, and 10 remain pending in U.S. Application Serial No. 10/663,838, with Claims 9 and 10 withdrawn from further consideration by the examiner as being drawn to a non-elected invention. An Office action on the merits follows.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d) (i.e., the certified copy of priority document JP 2002-270104, filed on 9/17/2002), which papers have been placed of record in the file.

Drawings

3. The drawings (2 sheets, 2 figures) filed by the applicant on 9/17/2003 are acknowledged and approved by the examiner.

Specification

4. The objections to the specification set forth in paragraphs 6 and 7 of the previous Office action (i.e., the non-final Office action mailed on 8/25/2005) are withdrawn in

light of (1) the applicant's submission of an acceptable abstract of the disclosure and
(2) the applicant's correction of the informalities previously noted by the examiner.

Claim Objections

5. The objection to Claim 1, set forth in paragraph 8 of the previous Office action, is withdrawn in light of the applicant's amendment to correct the informality noted by the examiner.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. The rejection of Claims 1 – 8 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention, set forth in paragraphs 10 – 12 of the previous Office action, is withdrawn in light of the applicant's amendments to (1) clarify that independent Claim 1 (from which Claims 2 – 7 depend) requires that the deposited layer itself, not "a graphite nanofiber", comprises a graphite nanofiber layer and a non-fibrous layer, and (2) clarify that Claim 7 requires forming lines comprising a catalyst metal on the substrate and then selectively forming graphite nanofiber layers only on the catalyst metal lines.

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 1 – 7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

10. Amended independent **Claim 1**, from which **Claims 2 – 7** depend, requires, in part, forming the catalyst layer directly onto the surface of a single-layer glass substrate or a single-layer silicon (Si) wafer substrate. The aforementioned limitation is not supported, either explicitly, implicitly, or inherently, by the originally filed specification. Specifically, while the originally filed specification generally disclosed depositing the catalyst layer onto a glass substrate or Si wafer substrate, there is no teaching or suggestion in the originally filed specification that (1) the catalyst layer is formed directly onto the surface of the substrate or (2) that the glass or Si wafer substrate is a single-layer structure. As such, Claims 1 – 7 contain subject matter that was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors had possession of the claimed invention at the time of filing.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

12. Claims 1 – 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Ulvac Corp (JP 2002-115059 A).

13. Ulvac Corp teaches all the previous limitations of **Claims 1 – 7** as set forth in paragraph 15 of the previous Office action, as well as teaching the newly-added limitation in independent Claim 1 that the catalyst layer be formed directly onto the surface of a single layer glass substrate or Si wafer substrate. Specifically, the “SOLUTION” section of the abstract of Ulvac Corp teaches that, “A substrate obtained by forming a catalytic metallic thin film of Fe, Co or an alloy containing at least one kind of those metals on the surface of a glass substrate or an Si substrate...” Paragraph [0008] also teaches that the catalyst layer is formed directly onto the surface of the glass or Si substrate. Additionally, Example (3) in paragraph [0034] explicitly teaches that the patterned Fe catalyst layer is deposited directly onto the surface of a one-layer (single layer) glass substrate. The applicant’s arguments filed on 11/22/2005 have been fully considered but are not persuasive. Specifically, the applicant argues that Ulvac Corp does not teach or suggest depositing the catalytic metallic thin film directly on the glass substrate or silicon

wafer. To support this argument, the applicant cites paragraph [0011] of the document. In response, the examiner agrees that some embodiments taught by Ulvac Corp include depositing a non-catalytic metal layer on the substrate prior to depositing the metal catalyst pattern/layer. As noted by the applicant, paragraph [0011] discusses such an embodiment. However, Ulvac Corp also explicitly teaches embodiments in which the metal catalyst pattern/layer is deposited directly onto the surface of a single layer glass substrate or Si wafer (Abstract, paragraphs [0008] and [0034]). Therefore, Ulvac Corp anticipates the applicant's claimed invention.

14. Claims 1 and 2 are rejected under 35 U.S.C. 102(b) as being anticipated by Dai et al. (WO 00/63115 A1).

15. Dai et al. teaches all the previous limitations of **Claims 1 and 2** as set forth in paragraph 19 of the previous Office action, as well as teaching the newly-added limitation in independent Claim 1 that the catalyst layer be formed directly onto the surface of a single layer glass substrate or Si wafer substrate. Specifically, Dai et al. teaches that a quartz glass substrate is coated with any suitable metal which is capable of supporting CNT growth (e.g., Fe, Co, etc.) – a metal catalyst layer – and then growing a layer of CNTs on the metal-coated glass substrate (page 6). As such, Dai et al. teaches forming the metal catalyst layer directly onto a single-layer quartz glass substrate, thereby anticipating the applicant's claims. The applicant's arguments filed on 11/22/2005 have been fully considered but are not persuasive. Specifically, the applicant argues that Dai et al. does not teach or suggest depositing

the catalytic film directly on the glass substrate or silicon wafer. To support this argument, the applicant cites the paragraph bridging pages 3 and 4 of Dai et al., which teaches that the catalyst is incorporated into the substrate or included in the C-containing material. In response, the examiner agrees that some embodiments taught by Dai et al. include incorporating the catalyst into the substrate or the C-containing material. However, Dai et al. also explicitly teaches embodiments in which the metal catalyst layer is deposited directly onto the surface of a quartz glass substrate prior to nanotube growth (page 6). Therefore, Dai et al. anticipates the applicant's claimed invention.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

17. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order

for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

18. Claims 1 – 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bower et al. (USPN 6,630,772).

19. Bower et al. teaches all the limitations of **Claims 1 – 5** as set forth in paragraph 17 of the previous Office action, except for a method wherein the catalyst layer is deposited directly onto the surface of a single layer glass substrate or Si wafer substrate. However, Bower et al. does explicitly teach depositing the a-C / nanotube layer directly onto a substrate (Col.7, lines 26 – 30). Additionally, Bower et al. teaches that the substrate is pre-coated with a catalytic metal such as Ni, Co, ferrite, etc. (Col.6, lines 45 – 47). Bower et al. also teaches that the substrate is typically a semiconductor, metal, etc. (Col.5, lines 14 – 20) and is made of a material that is generally reactive with carbon (e.g., carbon dissolving elements or carbide forming elements) so that an adherent nanotube film is grown on the substrate (Col.3, line 65 – Col.4, line 9; Col.5, lines 18 – 20; Col.6, line 57 – Col.7, line 31). As such, one of ordinary skill in the art would have been motivated to deposit the metal catalyst layer of Bower et al. directly onto the surface of a substrate made of a material that is generally reactive with carbon in order to reap the benefits taught by Bower et al., specifically anchoring the subsequently deposited nanotube film with the C-reactive material of the substrate. Bower et al. teaches that Si is one of the carbon-reactive materials from which the substrate is made (Col.6, lines 57 – 66) and that a Si wafer

is one example of a substrate upon which the nanotubes are deposited (Col.11, line 5). Therefore, it would have been obvious to one of ordinary skill in the art to deposit the metal catalyst layer of Bower et al. directly onto a single layer Si wafer substrate, as claimed by the applicant, with the reasonable expectation of successfully and advantageously using a substrate made out of a material (Si) that Bower et al. teaches to be reactive with carbon, thereby reaping the benefits taught by Bower et al. (i.e., using the C-reactive nature of the substrate to anchor the subsequently grown CNT layer thereon).

20. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bower et al. in view of Dai et al.

21. Bower et al. teaches all the limitations of **Claim 6** as set forth above in paragraph 19, except for a method wherein the preparation of the graphite nanofiber is carried out for 1 to 60 minutes. Specifically, Bower et al. is silent regarding the carbon nanotube growth time but does generally teach that the layer can have a widely variable overall thickness (Col.7, lines 23 – 25). Dai et al. teaches that, in the art of growing carbon nanotube films by CVD, the conditions will depend on the type of carbon containing gas used and the type of catalyst, as well as the length and density of the nanotubes required. In this regard, it is possible to vary the conditions, such as temperature, time, pressure, or flow rate to obtain nanotubes having different characteristics (page 4, lines 3 – 7), and doing so is within the skill set of one in the art (page 4, lines 13 – 14). In other words, Dai et al. teaches that the growth time is a

result / effective variable that influences the characteristics (length, density, etc.) of the carbon nanotubes grown in a CVD process. Therefore, it would have been obvious to one of ordinary skill in the art to optimize the growth time in the process of Bower et al. as a result / effective variable through routine experimentation. The exact growth time would, of course, depend on the characteristics of the nanotubes (length, density, etc.) desired by the purveyor in the art.

22. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bower et al. in view of Ulvac.

23. Bower et al. teaches all the limitations of **Claim 7** as set forth above in paragraph 19, except for carrying-out the method by forming catalyst metal lines on the substrate on which any graphite nanofiber cannot be formed and then selectively forming graphite nanofibers only on the metal lines according to the CVD method. Please note that the substrate of Bower et al. can be a Si wafer, as set forth above in paragraph 21. Additionally, Bower et al. teaches that the method is generally used to produce field emission devices comprising carbon nanotubes (Col.1, lines 14 – 15). Ulvac teaches that, in the art of growing carbon nanofibers on a substrate to produce a field emission device, the nanofiber growth catalyst layer can be formed in a pattern such as lines so that the nanofibers selectively grow only on the patterned metal catalyst lines and not on the rest of the substrate, thereby controlling the location of the nanofiber layer (i.e., forming the nanofibers on only those portions of the substrate where electron emissive material is required) (Abstract, paragraphs

[0009], [0010], [0016], [0018], [0031], and [0035]). Therefore, it would have been obvious to one of ordinary skill in the art to form catalyst metal lines on the substrate on which any graphite nanofiber cannot be formed and then selectively form the carbon nanotube layer only on the metal lines by the CVD method in order to produce the field emission device of Bower et al. in order to advantageously form the nanofibers on only those portions of the substrate where electron emissive material is required as opposed to the entire substrate.

Response to Arguments

24. Applicant's arguments filed on 11/22/2005 have been fully considered but they are not persuasive for the reasons set forth in the grounds of rejection above.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

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extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D. Markham whose telephone number is (571) 272-1422. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



WDM

Wesley D Markham
Examiner
Art Unit 1762



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER